



CorMag - Coronal Magnetograph

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ABSTRACT

The Turin Astrophysical Observatory, Italy, has developed a liquid crystal Lyot filter for spectro-polarimetric observations of the coronal green-line emission (FeXIV, 530.3 nm). The science goal of the planned observations is the study of the coronal magnetic fields that drive the dynamics of the solar wind. The Turin coronal magnetograph (CorMag) has been integrated, as focal-plane instrumentation, to the Zeiss-200/300 coronagraph of the Lomnický Peak Observatory, Slovakia. The Turin coronal magnetograph (CorMag) is a four-stage Lyot filter with an electro-optically tunable bandpass. The full width at half maximum of the filter is 0.15 nm. The center wavelength of the bandpass is tuned by using nematic liquid crystal variable retarders (LCVRs). A separate LCVR, in tandem with the filter, is used for the polarimetric measurements. The INAF-Turin team has successfully operated the CorMag during the 2010 eclipse, acquiring coronal images of the green line emission.

This presentation will illustrate the CorMag and Zeiss-200/300 coronagraph, and will describe the preliminary results from the first-light observations. The presentation will discuss the future observing plans from this new coronagraphic facility. These observations would provide the unique opportunity to start reviving ground-based coronagraphy in Europe by combining first-class, classical telescope technology (the Zeiss coronagraph at Lomnický Peak Observatory) with modern, cutting-edge electro-optical technology (the LC Lyot filter of the Turin Observatory) originally developed for space applications.

CorMag

Collimator triplet [CoT]	Focal length [mm]: 100 Diameter [mm]: 50 Glasses: N-LAF21/SF10/N-LAK8 Achromatic designed by Optec						
Liquid Crystal Tunable Filter [LCTF]	<table border="1"> <tr> <td>LCTF General</td> <td>Length [mm]: 90 Diameter [mm]: 60 Aperture [mm]: 20 Number of stages: 4 FSR [nm]: 2.7 FWHM [nm]: 0.15 Center wavelength [nm]: 528.64 – 533.38 Tuning step [nm]: 0.01</td> </tr> <tr> <td>Pre-filter</td> <td>Manufacturer: Andover Corp. Center wavelength [nm]: 530.69 FWHM [nm]: 1.89</td> </tr> <tr> <td>LCVR</td> <td>Manufacturer: MLO Rotation angles [deg]: 0 - 180</td> </tr> </table>	LCTF General	Length [mm]: 90 Diameter [mm]: 60 Aperture [mm]: 20 Number of stages: 4 FSR [nm]: 2.7 FWHM [nm]: 0.15 Center wavelength [nm]: 528.64 – 533.38 Tuning step [nm]: 0.01	Pre-filter	Manufacturer: Andover Corp. Center wavelength [nm]: 530.69 FWHM [nm]: 1.89	LCVR	Manufacturer: MLO Rotation angles [deg]: 0 - 180
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Camera triplet [CaT]	Focal length [mm]: 100 Diameter [mm]: 50 Glasses: N-LAF21/SF10/N-LAK8 Achromatic designed by Optec						
Detector [D]	Type: CCD Camera FU Proline 1001E Sensor: Kodak KAF-1001E Frame size [pixels]: 1024x1024 Pixel size [µm]: 24 A/D Conversion [bit]: 16						

CorMag @ 2010 TSO

Lomnický Stit Observatory (LSO)

CorMag Calibrations and Performances

Measured vs. Model: Plot of Transmission (AU) vs Wavelength (nm) comparing measured data with a model fit.

Fine Tuning: Plot showing transmission peaks for different center wavelengths (530.3, 530.35, 530.4, 530.38 nm).

Time Stability: Plot showing transmission stability over time for a fixed wavelength.

Temperature Dependence: Plot showing transmission stability for different temperatures (21.4 Deg, 21.5 Deg, 21.6 Deg, 21.7 Deg, 21.8 Deg, 21.9 Deg, 22.0 Deg).

Angle of Incidence Study: Plot showing transmission vs wavelength for different angles of incidence (0, 1, 2, 4, 6 degrees).

Prefilter: Plot showing the transmission profile of the prefilter.

Polarization Rotator: Plot of Measured Rotation vs Requested Rotation, showing a linear relationship.

Interferogram (OPD): Color-coded interferogram showing optical path difference.

CorMag @ Lomnický Stit Observatory

Installation during the last quarter of 2013, first quarter of 2014. After the first light, the preliminary data acquisitions and system debugging are actually in progress

LSO Zeiss Coronagraph

At the summit of Mt Lomnický štít, 2634 m a. s. l., a new coronagraph of the Astronomical Observatory of the Slovak Academy of Sciences at Skalnaté Pleso, built by C. Zeiss in Jena, has been installed in 1962. Fig. 1 shows the optical scheme of the instrument. Objective 1 is a simple lens, 20 cm in dia., and 300 cm focal length. In its focal plane is exchangeable Lyot diaphragm 2. The instrument is focused by moving the objective along the optical axis, which permits observations in the spectral region from 3930 Å to 10 800 Å. The intermediate optical system of the coronagraph is made up by field lens 3, further three members together with iris diaphragm 6, and imaging objective 8. Behind this objective is the space reserved for filter 9. The light pencils passing this space have the convergence 1 : 20 and the axes parallel to the optical axis of the instrument; thus, the maximum ray inclination to the optical axis is about 1°25'. The image of the Sun, 40 mm in diameter, is obtained in focal plane 10, where it can be observed visually or taken on film with a "Practina" type camera.

So far prominences have been observed with the coronagraph by using a Šolc filter 8 Å pass-band. A mirror spectrograph has been designed for observations of coronal lines.

Fig. 1. Optical system of the coronagraph.

References

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- Capobianco, G. et al., OATo TR. N. 152, 153

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